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6 CHAPTER SIX: QUALITY CONTROL PROCEDURES

The foundation for a successful Quality Assurance program is the quality control maintained by the Producer to assure that all materials submitted for acceptance conform to the contract requirements. To accomplish this it is imperative that the Producer have a functional plan to keep the process in control, quickly determine when the process goes out of control, and respond adequately to bring the process back into control.

This section includes the minimum requirements of the Indiana Certified Volumetric Hot Mix Asphalt Producer Program (Program) in accordance with **ITM 583**. The mixtures included in this Program include QC/QA HMA in accordance with Section **401** of the Standard Specifications and HMA in accordance with section **402** of the Standard Specifications.

PRODUCER PERSONNEL

The Producer personnel required include a Management Representative and a Certified Asphalt Technician.

Management Representative

The Management Representative is responsible for all aspects of production and control required by the Certified Hot Mix Asphalt Producer Program at each Certified Plant.

Certified Asphalt Technicians

A Certified Asphalt Technician is a Producer or Consultant employee who has been certified by INDOT. The Certified Asphalt Technician compacts and determines the bulk specific gravity of the Superpave gyratory specimens and performs the maximum specific gravity test. The Technician supervises all other sampling and testing of materials, the maintenance of control charts, and the maintenance of the diary.

All sampling and testing used for acceptance of materials is required to be conducted by a Qualified Technician. A Qualified Technician is an individual who has successfully completed the written and proficiency testing requirements of the INDOT Qualified Laboratory and Technician Program. Certified Asphalt Technicians are not required to take the written exam of this Program.

REFERENCE PUBLICATIONS

Each Certified Plant laboratory is required to have the following current documents on file:

1) Indiana Department of Transportation Certified Volumetric Hot Mix Asphalt Producer Program (**ITM 583**).

2) Indiana Department of Transportation Standard Specifications (Includes applicable Supplemental Specifications and pertinent contract Special Provisions).

3) Indiana Hot Mix Asphalt Quality Assurance Certified Technician Program Manual.

4) All applicable INDOT, AASHTO, and ASTM Test Methods.

5) Testing equipment calibrations or verifications.

6) Mix design, and design mix formula (DMF) or job mix formula (JMF) for each mixture.

7) Fines correction data for each DMF and JMF, if applicable.

8) Process control test results.

9) Control charts.

Each Certified Plant is required to have these current documents:

1) The Quality Control Plan (QCP) for the Certified Plant.

2) Weigh tickets indicating material is from an Approved Supplier Certification Producer.

3) Instructions from the manufacturer concerning storage and handling of the binder.

4) Plant calibrations for each DMF.

5) Temperature recordation charts of the aggregate or mixture.

6) Diary.

7) The calibrations of the Plant scales and verification of meters.

FIELD LABORATORY

A laboratory is required to be provided and maintained at the plant site with the necessary equipment and supplies for performing quality control testing. Performance of quality control tests at laboratory facilities other than the plant site laboratory are permitted provided that all test procedure criteria are satisfied and the test results are furnished in writing to the plant site laboratory within 24 hours of sampling. INDOT is permitted access to inspect any laboratory used for quality control testing and to witness quality control activities.

TEST EQUIPMENT CALIBRATION

The equipment furnished for testing is required to be properly calibrated and maintained within the calibration limits described in the applicable test method. A record of calibration results is maintained at the field laboratory for the equipment listed in Figure 6-1.

Equipment	Requirement	Minimum Frequency	Procedure
Balances	Verification	12 mo.	ITM 910
Gyratory Compactor	Verification	1 mo.	ITM 908
Ignition Oven	Calibrate	Each Mix	ITM 586
Mechanical Shakers	Check Sieving Thoroughness	12 mo.	ITM 906
Nuclear Asphalt Content Gauge	Calibrate	Each Mix	AASHTO T 287
Ovens	Verify Temp. Settings	6 mo.	ITM 903
Sieves	Check Physical Condition	6 mo.	ITM 902
Thermometers	Verification	6 mo.	ITM 909
Vacuum Pump	Check Pressure	12 mo.	ITM 905
Volumetric Flask	Calibrate	1 mo.	AASHTO T 209

Figure 6-1. Equipment Calibration Requirements

DIARY

The Producer is required to maintain a diary at the Certified Plant. The diary is an open format book with at least one page devoted to each day mixture is produced. The diary is kept on file for a minimum period of three years.

Entries in the diary include at least the following:

1) The quantity of HMA produced, DMF or JMF, and the contract number or purchase order for each mixture;

2) The time that the samples were obtained and the time the test was completed;

3) Nonconforming tests and the resulting corrective action taken; and

4) Any significant events or problems.

The diary entry is to be routinely signed by the Certified Asphalt Technician or Management Representative. On occasion it may be signed by another person; however, it must then be counter-signed by the Certified Asphalt Technician or Management Representative.

MATERIAL SAMPLING

The Producer is required to designate the sampling and sample reduction procedures, sampling location, and size of samples necessary for testing. Sampling is performed on uniform tonnage increments on a random basis.

Aggregate/RAP Sampling

Aggregate samples may be obtained from stockpiles, belts, or hot bins depending on the type of plant and control of aggregate gradation selected. The procedures for these methods of sampling are described in Chapter 2. If RAP is used in the HMA, the procedure for sampling this material is **ITM 207**.

Binder Sampling

Two one quart samples are obtained from either the Certified Plant binder tank or injection line in accordance with **AASHTO T 40**. The procedure for sampling binder is described in Chapter 3.

HMA Sampling

The most important consideration in sampling HMA is to be certain that the sample taken is representative of the material being produced. The sampling procedures for HMA are included in **ITM 580**. Procedures for truck sampling and pavement sampling are explained as follows:

Truck Sampling

1) A square bit shovel is inserted horizontally into the HMA at the approximate mid section of the truck.

2) The shovel is lifted vertically to establish a horizontal plane in the HMA.

3) The shovel is inserted vertically to establish a vertical face below the horizontal plane.

4) The shovel is inserted horizontally into the vertical face at a depth of approximately twice the thickness of the maximum particle size of the material.

5) The shovel is lifted vertically to obtain the sample, and the sample is placed into a sample container.

Pavement Sampling -- HMA Thickness Equal to or Less Than 3 in..

1) A clean metal plate with attached wire is placed on the pavement. (A minimum 8 in. x 8 in. size plate is required). Should conditions on the project require stabilizing movement to avoid slipping of the plate, a nail is driven into the pavement, and the plate hole placed onto the nail. A No. 18 gage mechanics wire and masonry nail has proven to be effective for this purpose.

2) The wire is extended beyond the edge of the paving width. The wire should not pass under a grade leveler attached to the paver. Trucks, pavers, or material transfer devices are allowed to cross the plate and/or wire. If a windrow elevator is used, the paving operation is stopped so that the plate can be placed between the windrow elevator and the paver.

3) After the mixture is placed and before any compaction from the rollers occurs, the wire is used to locate the plate.

4) The plate is lifted with the wire, a narrow shovel or pitchfork is inserted under the plate, and the plate is lifted from the pavement.

5) The sample is then placed in a container for transport to the testing facility. Material remaining on the plate should be removed and placed into the sample container.

Pavement Sampling -- HMA Thickness Greater Than 3 in.

The placement and location of the plate are done using the same procedures and restrictions used for sampling a HMA thickness equal to or less than 3 in. Additional requirements include:

1) A clean round mold, with a height greater than the HMA thickness and diameter less than the width of the plate, is pushed by means of a circular motion down into the HMA directly over the plate.

2) The mold and plate are raised together and a pitchfork or narrow shovel is inserted under the plate.

3) The mold and plate are lifted from the pavement and any excess HMA on top of the plate and outside of the mold is discarded.

4) The sample inside the mold is placed into the sample container. Material remaining on the plate is removed and placed into the sample container.

HMA Sample Reduction

Once the sample is obtained, the next step required is to reduce the sample to the appropriate test size. The sample reduction procedures are included in **ITM 587**. Sample reduction to meet a minimum weight and a weight range are as follows:

Minimum Weight -- HMA Extraction, Maximum Specific Gravity, and Bulk Specific Gravity

1) The sample is placed on a clean splitting board and thoroughly mixed with a trowel.

2) The sample is then quartered into four approximately equal portions, the diagonally opposite quarters are combined, and the sample weighed.

3) If the sample weight does not meet the minimum weight requirement of the appropriate test method, the sample is set aside and the remaining mixture is recombined, mixed, and quartered again.

4) The diagonally opposite quarters of the recombined mixture are added to the sample that was set aside. This procedure is repeated until the appropriate test size is obtained.

5) If the sample after combining the diagonally opposite quarters of the original sample is excessively large, the sample may be discarded. The remaining mixture is recombined and quartered, as indicated above, until the appropriate size of sample is obtained.

Weight Range -- Ignition Oven

The procedure for reducing a sample for testing using the ignition oven is different than the above procedure because the sample size is required to be within a weight range. The procedure is as follows:

1) The sample is placed on a clean splitting board and thoroughly mixed with a trowel.

2) The sample is then quartered into four approximately equal portions, the diagonally opposite quarters are combined, and the sample is weighed.

3) If the sample weight does not meet the minimum weight requirement for the ignition test, the sample is set aside, and the remaining mixture is recombined, mixed, and quartered again.

4) The diagonally opposite quarters of the recombined mixture are added to the sample that was set aside.

5) If the total sample weight is less than the required minimum weight, the quartering procedure is repeated with the remaining mixture until a proper weight is obtained.

6) If the sample, after combining the diagonally opposite quarters of the additional mixture to the original sample, exceeds the maximum weight requirement for the ignition test, the additional sample is discarded and the quartering procedure as noted above is continued for the remaining mixture until the proper weight is obtained.

MATERIAL TESTING

The Producer is required to designate the testing procedures to be used for control of the aggregates, RAP, and HMA. Testing should be completed within 48 hours of the time the sample was taken. The Producer is required to keep the test results on file for a minimum period of three years.

Aggregate Testing

Gradation

Gradations conducted on blended aggregate or aggregate stockpile samples are conducted using **AASHTO T 27**. If RAP is used in the HMA, the test procedure for the gradation is **AASHTO T 30**.

Moisture Content

AASHTO T 255 is the test procedure used for determination of the total moisture content of the cold feed belt or belt discharge aggregate samples for a drum plant.

HMA Testing

The analysis of the HMA to meet the requirements of the Program include several tests. Detailed procedures of these tests are included in appendices A and B. The tests include:

Mixture Calibration

A plant calibration is required to be made for each HMA to be produced in accordance with the following methods:

Batch Plants -- the percentage of the total aggregate to be obtained from each hot bin and the RAP belt.

Drum Plants -- the percentage of the total aggregate to be obtained from each cold bin and the RAP bin.

Moisture Content

ITM 572 outlines the procedure for determination of the moisture content. Of particular importance is that the sample be placed immediately into an oven bag when obtaining the sample so that an accurate moisture content may be obtained.

Binder Content

Several methods are allowed for determination of the binder content; however, the Ignition Method (**ITM 586**) and the Extraction Method (**ITM 571**) are the most common procedures.

Extracted Aggregate Gradation

After the binder content has been determined in accordance with **ITM 571**, the sieve analysis of the aggregate is made using **AASHTO T 30**, except the decantation through the No. 200 sieve is not required. If the Ignition Oven is used, the aggregate sample is first decanted and then the sample is sieved in accordance with **AASHTO T 30**.

Coarse Aggregate Angularity

If gravel is used in the HMA or the RAP contains gravel, the coarse aggregate angularity (crushed content) is determined after the sieve analysis. **ASTM D 5821** is the procedure used for determination of both one and two faced crushed particles.

HMA Specimen Preparation

Specimens to determine the voids and VMA at the plant are compacted to Ndes in accordance with **AASHTO T 312**.

Bulk Specific Gravity

AASHTO T 166 is the procedure used for determination of the bulk specific gravity of the gyratory specimens.

Maximum Specific Gravity

AASHTO T 209 is the procedure used for determination of the maximum specific gravity of the HMA. The supplemental procedure for mixtures containing porous aggregates may be required if the aggregate absorbs water during the test.

Temperature

The best procedure to determine the temperature of the HMA is with a dial and armored-stem thermometer. The stem should be inserted sufficiently deep (at least 6 in.) into the HMA, and the material should be in direct contact with the stem.

The gun-type infrared thermal meter, which measures reflective heat from the surface, may also be used. This device detects only surface heat and may not be accurate for material within the load. To overcome this problem, the technician should aim the instrument at the stream of HMA at the discharge gate of the mixer or surge bin.

FREQUENCY OF TESTS

QC/QA HMA

The frequency of tests is determined by the Producer and is required to be included in the QCP for the following items:

1) Aggregates
   a) Stockpiles
   b) Blended Aggregate

2) Binder

3) Recycled Materials
   a) Binder Content
   b) Gradation
   c) Moisture
   d) Coarse Aggregate Angularity

4) Mixture Sampled at the HMA plant
   a) Binder Content
   b) Moisture
   c) Temperature

5) Mixture Sampled from the Pavement
   a) Air Voids
   b) VMA
   c) Actual Binder Content
   d) Moisture (for surface mixtures only)

HMA

HMA mixture produced concurrently with QC/QA HMA mixture is required to be sampled and tested in accordance with the requirements established for QC/QA HMA. All other HMA is required to be sampled at the HMA plant or the roadway and tested for binder content, coarse aggregate angularity for mixtures containing gravel, gradation, and air voids in accordance with the following minimum frequency:

1) The first 250 tons and each subsequent 1000 tons of each DMF or JMF in a construction season for base and intermediate mixtures; and

2) The first 250 tons and each subsequent 600 tons of each DMF or JMF in a construction season for surface mixtures.

ADJUSTMENT PERIOD -- QC/QA HMA

The Producer is allowed an adjustment period for each DMF in which changes can be made. The adjustment period is from the beginning of production and extending until 4000 tons of base and intermediate mixtures or 2400 tons of surface mixture has been produced. The production is required to be on one contract and a reduced adjustment period may be allowed. A JMF is established after the adjustment period. The following adjustments are allowed:

1) The amount passing all sieves on the DMF may be adjusted provided the gradation limits and the dust/calculated effective binder ratio do not exceed the limits of Section **401.05** of the Standard Specifications.

2) The binder content may be adjusted ± 0.5 percent provided the dust/calculated effective binder ratio is in accordance with **401.05**.

3) The VMA may be adjusted provided the new value is in accordance with **401.05**.

If an adjustment is necessary, a JMF is submitted in writing for approval to the DMTE upon completion of 6000 t of base or intermediate mixture, 3600 t of surface mixture, or a reduced adjustment period. The JMF shall include the adjusted gradation, binder content or VMA, unit weight at N_{des}, and the dust/calculated effective binder ratio, if applicable.

Only one adjustment period is allowed for each DMF within a construction season. If production extends into the next construction season, the DMF is allowed another adjustment period. If a JMF was approved, the adjustments are made from the JMF.

CONTROL CHARTS -- QC/QA HMA

A control chart is a graphic representation of data shown with prescribed limits that indicate whether a process is in control. Timely reaction to the control chart can prevent the production of nonconforming material.

Control charts are maintained by the Producer at the Certified Plant laboratory. All test results are recorded on the control charts the same day the tests are conducted. As a minimum the charts are maintained until 30 test data points have been plotted. Subsequent to that time at least 30 test data points are continuously displayed. All charts are required to be retained by the Producer for the Certified Plant for a period of three years.

Application

As a minimum, control charts are required for each QC/QA HMA mixture as follows:

1) Critical sieve(s) for each aggregate size from stockpile samples as designated by the Producer. A minimum of one critical sieve is required;

2) Critical sieves for each blended aggregate as designated by the Producer. A minimum of four sieves for base and intermediate mixtures, and a minimum of three sieves for surface mixtures are required to be identified by the Producer;

3) Binder content of the QC/QA HMA mixture for each DMF and JMF; and

4) Air voids and Voids in Mineral Aggregate for each DMF and JMF.

Control Limits

The control limits from the target mean value for individual test values are as shown in Figure 6-2.

Parameter	Control Limits
Aggregate Stockpile Samples, % Passing Sieves	
1 1/2 in.	± 15.0
1 in.	± 10.0
3/4 in.	± 10.0
1/2 in.	± 10.0
No. 4	± 10.0
No. 8	± 10.0
No. 16	± 8.0
No. 30	± 6.0
No. 50	± 6.0
No. 100	± 6.0
No. 200	± 2.0
Blended Aggregate, % Passing Sieve Base and Intermediate Mixtures	
1 1/2 in.	± 15.0
1 in.	± 10.0
3/4 in.	± 10.0
1/2 in.	± 10.0
No. 4	± 10.0
No. 8	± 10.0
No. 16	± 8.0
No. 30	± 6.0
No. 50	± 6.0
No. 100	± 6.0
No. 200	± 2.0
Blended Aggregate, % Passing Sieve Surface Mixtures	
3/4 in.	± 10.0
1/2 in.	± 10.0
No. 4	± 10.0
No. 8	± 8.0
No. 16	± 8.0
No. 30	± 4.0
No. 50	± 4.0
No. 100	± 3.0
No. 200	± 2.0
Binder Content of Mixture (%)	± 0.7
Air Voids @ Ndes, (%)	± 1.0
Voids in Mineral Aggregate @ N_{des},(%)	± 1.0

Figure 6-2. CONTROL LIMITS

Target Mean Values

The target mean values are required to be as follows:

Aggregate Stockpiles -- the values designated by the Producer.

Blended Aggregate Samples -- the values designated by the Producer.

Binder Content -- the values for the QC/QA HMA from the DMF and JMF

Air Voids -- the value designated by the Producer.

Voids in Mineral Aggregate -- the value from the DMF and JMF.

Control Chart Construction

The control chart is required to be plotted in accordance with specific requirements. Any proposed deviation of the procedures must be clearly identified in the QCP. The requirements are as follows:

1) The target mean value is represented by a heavy long dash followed by a short dash line;

2) Control limits are represented by heavy solid lines;

3) The placement of the horizontal lines for the control limits and target mean value are numerically identified in the left margin;

4) The plot point for the test results is surrounded by a small circle and each consecutive point is connected by a solid straight line;

5) The moving average of the most current five test values is indicated by a small triangle symbol and connected by straight lines;

6) The test results are plotted left to right in chronological order and dates corresponding to each test are shown along the horizontal axis; and

7) All values are plotted to the nearest 0.1 percent.

Test results for samples obtained from other than at the Certified Plant may be plotted on the corresponding chart provided the points are not connected with the test results from the Certified Plant and the test results are not included in the moving average. An example of a control chart is shown in Figure 6-3.

Five-Point Moving Average

For a moving average of five test values the group of the first five measurements is averaged and this point is plotted on the control chart. When an additional test value is obtained, the first value is dropped, the sixth value is added, and the new group averaged. When a seventh value is obtained, the second value is dropped, and the new group averaged, and so on. An example of this procedure is as follows:

Data: 4.8, 5.3, 5.0, 4.7, 5.1, 5.5, 4.6

$$\text{First Average} = \frac{4.8 + 5.3 + 5.0 + 4.7 + 5.1}{5}$$

$$= \frac{24.9}{5} = 5.0$$

The first number, or 4.8, is dropped and the sixth value, or 5.5, is added and the second average is:

$$\text{Second Average} = \frac{5.3 + 5.0 + 4.7 + 5.1 + 5.5}{5}$$

$$= \frac{25.6}{5} = 5.1$$

Next, the 5.3 is dropped and 4.6 is added:

$$\text{Third Average} = \frac{5.0 + 4.7 + 5.1 + 5.5 + 4.6}{5}$$

$$= \frac{24.9}{5} = 5.0$$

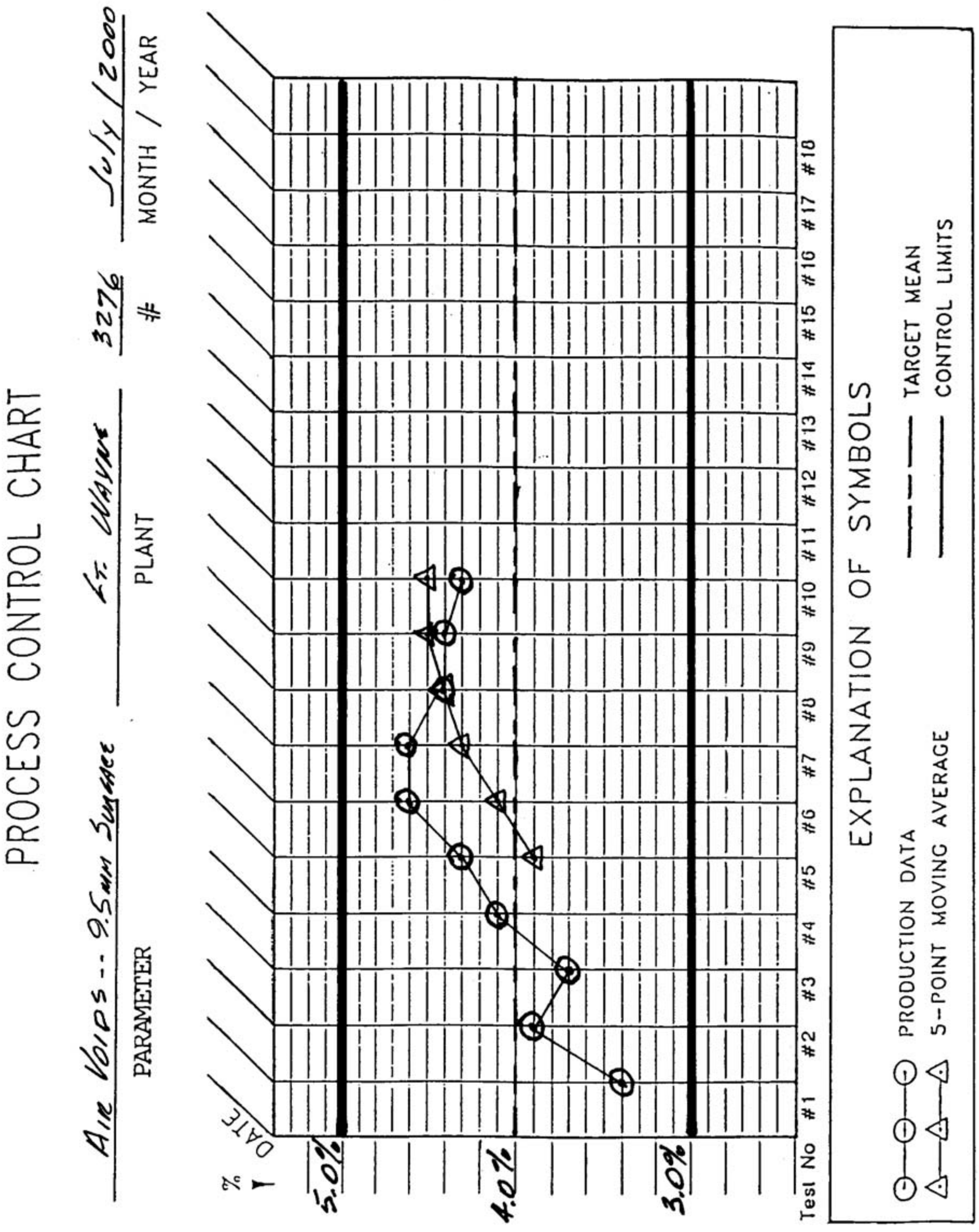


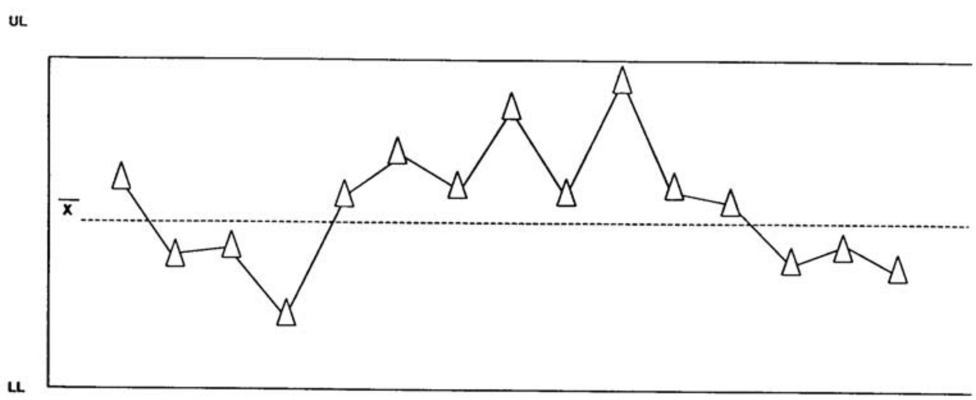
Figure 6-3. Control Chart

Chart Interpretation

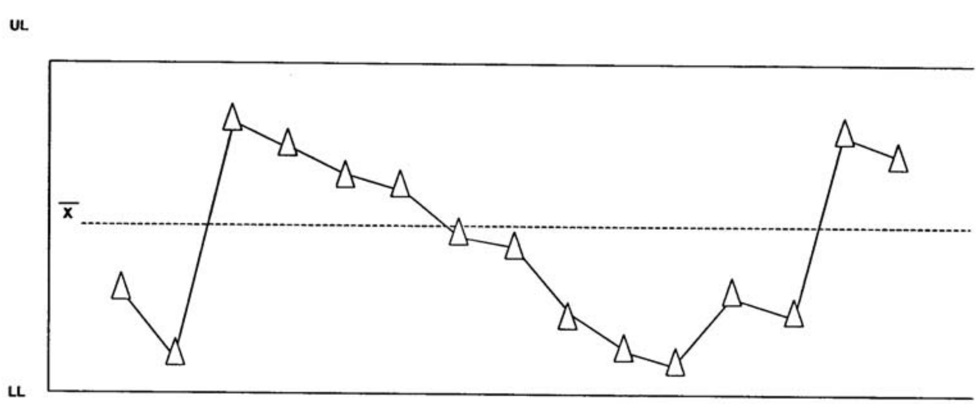
The moving average of the last five values is useful in determining the accuracy of the process. Averages tend to lessen the effect of erratic data points that could reflect errors not related to the actual material (sampling, testing, etc.). The presence of unusual patterns or trends may be evidence of nonconformance during the period of the pattern. Any of the following potential nonconforming conditions (Figure 6-4) involving the moving average should be investigated.

1) 7 or more points in a row are above or below the target mean;

2) 7 or more points in a row are consistently increasing or decreasing; or



7 or more points in a row above or below mean



7 or more points in a row are increasing or decreasing

Figure 6-4. Five-Point Moving Average Trends

RESPONSE TO TEST RESULTS

Control Charts

The Producer is required to take corrective action when the control limits for QC/QA HMA or Specification Limits for HMA mixtures are exceeded for the appropriate properties of aggregate stockpiles, blended aggregate, binder content of the mixture, RAP binder content, air voids and VMA. Corrective action includes, but is not limited to, investigation for assignable cause, correction of known assignable cause, or retesting.

Moisture Content

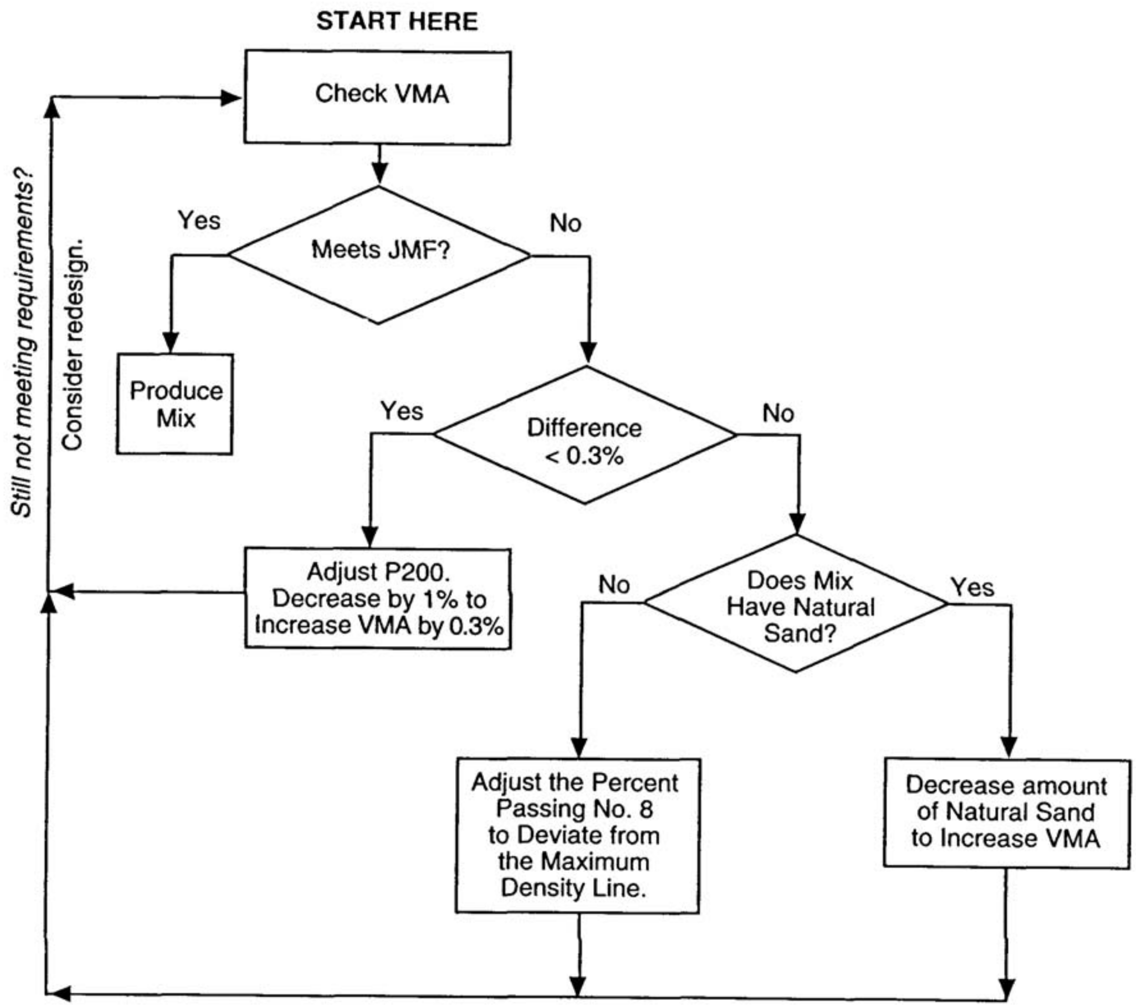
The Producer is required to take corrective action when the moisture content of the HMA exceeds 0.3 percent for mixture samples taken at the plant.

VOLUMETRIC CONTROL

Verification of the volumetric HMA properties is one of the most important duties of the certified technician. Changes in the material or control at the HMA plant can result in the air voids and VMA falling outside of the specification limits. The general trend is that the design air voids and VMA will decrease during production at the plant. This section contains information concerning the steps that may be taken to correct a deficient volumetric property. In order to use these guidelines, the HMA composition must be reasonably close to the designed HMA.

VMA

Figure 6-5 is a flow chart for VMA adjustment for plant - produced HMA. The amount of material passing the No. 200 sieve and the relative proportions of coarse and fine aggregate can significantly affect the VMA. A loss of VMA is a common problem during production.



VMA = Voids in Mineral Aggregate
AV = Air Voids
P200 = Percent passing 0.075 mm (#200) sieve

NOTE: This flow chart is intended to provide guidance for adjustment of VMA. Due to differences in properties of specific mixes, the effect of the adjustments may be variable.

Figure 6-5. VMA Adjustment Process

Gradation changes may be caused by a mechanical problem with the plant. A comparison of the blended aggregate and extracted aggregate gradations is a good technique to verify if this problem exists. Also, there will, in most cases, be some "rounding" of the edges of the coarse aggregate particles as they pass through the drum. This rounding of the aggregate will lower the VMA.

Dust variation in the HMA may be caused by variations in the minus No. 200 sieve material of the aggregates; however, a change in the dust is more likely to be the result of the inconsistent return of fines from the plant baghouse. Specifications require that if dust is returned into the HMA, the system must return the material at a constant rate during production. A check on the fines return system should be made to verify this constant rate of return of fines.

Adjusting for low VMA is the more common problem a technician will need to correct. Procedures for increasing the VMA include:

1) Reduce the amount of material passing the No. 200 sieve;

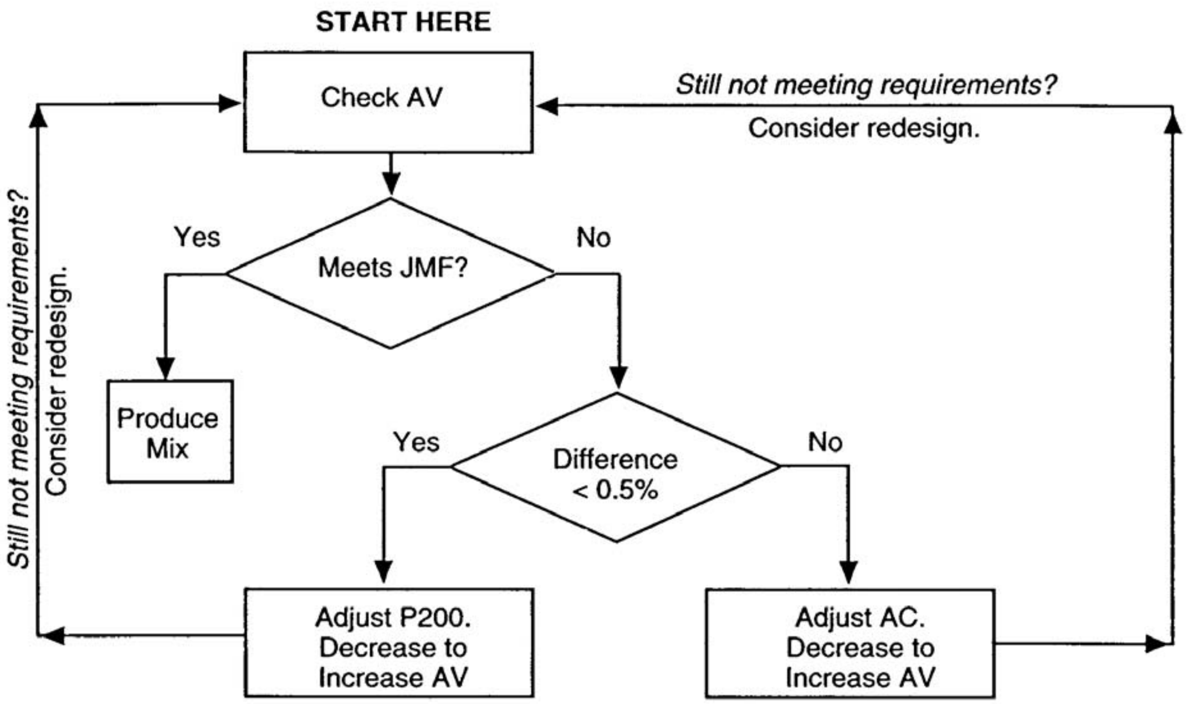
2) Reduce the amount of natural sand in the HMA; and

3) Adjust the aggregate gradation away from the Maximum Density Line.

Air Voids

Figure 6-6 is a flow chart for adjusting air voids for plant-produced HMA. Air voids are influenced by a combination of VMA, percent passing the No. 200 sieve, and the binder content. Adjustments of the air voids is dependent on the magnitude of the variance between the production and JMF values. If the difference is greater than 0.5 percent, consideration should be given to adjusting the binder content; if the difference is less than 0.5 percent, the percent passing the No. 200 sieve may be adjusted.

A comparison of the production bulk specific gravity (Gmb) and maximum specific gravity (Gmm) values to the DMF and previous production values should also be done. Different Gmb values may be caused by an aggregate gradation change (especially the P 200) or by a particle shape change from aggregate breakdown. Different Gmm values may be caused by a binder content, aggregate absorption, or aggregate specific gravity change.



VMA = Voids in Mineral Aggregate
AV = Air Voids
P200 = Percent passing 0.075 mm (#200) sieve

NOTE: This flow chart is intended to provide guidance for adjustment of AV. Due to differences in properties of specific mixes, the effect of the adjustments may be variable.

Figure 6-6. Air Voids Adjustment Process

The air voids, as with the VMA, will need to be increased in most cases when the specifications are not being met. Procedures for increasing the air voids include:

1) Reduce the binder content;

2) Reduce the amount passing the No. 200 sieve; and

3) Change the relative proportion of coarse and fine aggregate.

HMA TROUBLESHOOTING

Figure 6-7 lists the materials and properties that are verified at the HMA plant and the possible causes of problems with these materials. For each property the potential problem areas are given a priority number with the number 1 being the area that should be checked first.

Verification of the mix design prior to production for the project is the best procedure to prevent potential problems. By using the actual stockpiled materials and testing the effect the HMA plant has on those materials, adjustments can be made to the HMA to meet the requirements.

During production there are other means available to make a quick determination of the properties of the HMA. For volumetric determinations, the air voids and VMA can be approximated by estimating the bulk specific gravity (Gmb) of the HMA. This estimation of Gmb is made from the height of the gyratory specimen when a constant sample mass is used.

		AGG. STOCK-PILES	BLENDED AGG. GRADATION	MIX BINDER %	RAP BINDER %	AIR VOIDS	VMA
		Priority	Priority	Priority	Priority	Priority	Priority
01	Results / Sampling / Test Equipment: Verify	1	1	1	1	1	1
02	Stockpiles: Visually Check Segregation	2	2		2		
03	Loader Operations: Check	3	3		3		
04	Stockpiling & Trucking: Check	4	4				
05	CAPP Source: Discuss Findings	5	8				
06	Cold Feed – Loading		5				
07	Cold Feed – Contamination		6				
08	Cold Feed– Gates / Control Systems / Blend Percents		7				
09	Gradation vs. Binder %: Graph			3	5		
	A. Mix: Segregation?			3A	5A		
	B. Plant: Malfunction / Deterioration?			3B	5B		
10	Plant Settings: Check			2			
11	Total Binder Consumption vs. Mix Production: Check			5			
12	RAP: Processed RAP / Uniformity/ Binder Content			4	4		
13	Mix Gradation: Check					3	2
14	Mix Agg. Blend of Components (Particle Shape Issues): Check					4	4
15	Mix Binder Content					2	3
16	Agg. Specific Gravity (Gse), (Gsb) and Absorption: Check.						5
17	Adjust/Respond As Appropriate & Per QCP (Don't over-react)	6	9	6	6	5	6
18	Verify Success of Changes & Check Impact on Other Control Factors	7	10	7	7	6	7
19	QCP Addendum: Submit if Applicable	8	11	8	8	7	8

Figure 6-7. HMA Troubleshooting Chart

QUALITY CONTROL PLAN

Each Producer providing QC/QA HMA or HMA under the Certified Volumetric Hot Mix Asphalt Producer Program is required to have a written QCP which is plant specific and is the basis of control. The QCP contains, but is not limited to, the methods of sampling, testing, calibration, verification, inspection, and anticipated frequencies.

The QCP includes the following information for each Certified Plant.

1) The location of the Certified Plant site, including the county and reference to the nearest identifiable points such as highway and towns.

2) The name, telephone number, duties, and employer of the Management Representative and Certified Asphalt Technician(s). The duties of all other personnel responsible for implementation of the QCP are also included.

3) A list of test equipment that is calibrated or verified, the test methods and frequency of calibration or verification of the equipment, and a statement of accessibility of the laboratory to INDOT personnel. If the laboratory is not located at the Certified Plant, the location of the laboratory is required to be designated, and the procedure for transporting the HMA to the laboratory included.

4) A plant site layout diagram that includes the location of the stockpile area, binder tanks, fuel tank, additive or modifier supply, anti-adhesive supply, field laboratory, visitor parking area and mixing plant.

5) A plan for controls of the aggregate and recycled material stockpiles. Controls for identification of stockpiles by signing or other acceptable methods, techniques for construction of proper stockpiles, and cold bin loading procedures are required to be included.

6) A plan for the use of more than one binder grade in a binder tank.

7) The procedure for the consistent uniform addition of baghouse fines when returned into the mixing plant.

8) The procedure for using an anti-adhesive agent for the truck bed, and a statement that the agent is on the list of Approved Anti-Adhesive Agents.

9) The procedure for sealing the surge bin when used for extended storage of the HMA. The written approval of the surge bin is required to be included.

10) The procedure for loading HMA into the trucks.

11) A sampling plan that includes locations, test methods, devices, techniques, frequencies, and splitting procedures.

12) A testing plan that includes the types of tests, and test methods.

13) A description of any other process control techniques that may be used beyond the minimum required by INDOT. These controls may include, but are not limited to:

    a) Different types or greater frequencies of material testing; and/or
    b) Visual checks, and monitoring of plant production.

14) A statement of the procedure for handling addenda to the QCP including a time schedule for submittal.

15) A documentation plan with details on control charting, test data, and the diary. Copies of the forms may be included.

The Producer is required to transmit all applicable process control changes to the District Materials and Tests Engineer in a timely manner for approval. This is done in the format of addenda to the QCP. Each page of the QCP that is revised is required to include the Certified Plant number, date of revision, and means of identifying the revision. A signed and dated authentication page is required to be included.

CERTIFICATION

Each Producer requesting to establish a Certified Plant is required do so in writing to the Chief, Materials and Tests Division. Upon receipt of the request for certification the District is notified to inspect the plant laboratory.

The plant inspection, including the correction of any deficiencies and calibration of all meters, scales and other measuring devices, is required to be completed prior to certification.

Each plant meeting the requirements of the Program is certified upon the approval of the QCP. Movement of the Certified Plant to a new location requires an addendum to the QCP.